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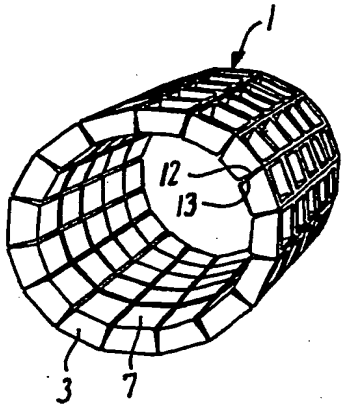

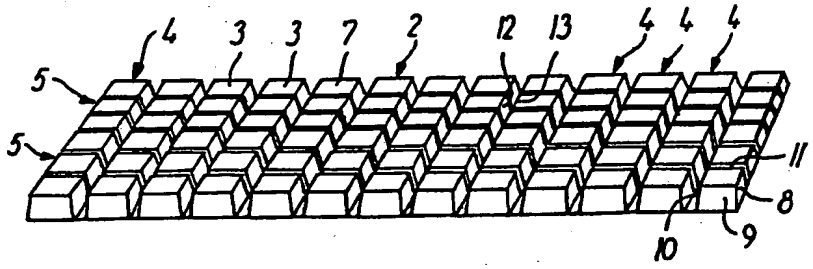

(57) Abstract

A tube serves in particular as core tube for winding up web shaped material. In order to achieve a stable and cheap tube the tube consists of a piece of material (2) bent into tubular shape. On the piece of material rows of hollow projections (3) are arranged. When the piece of material has been bent into the tubular shape, the projections (3) face with their tops (7) inwardly and the latter comprise abutment surfaces or edges (12, 13) facing each other. The projections (3) arranged along the edges of the piece of material (2) extending in the longitudinal direction of the tube (1) are shaped for mutual engagement. An object to be used for forming such tube has the shape necessary for this purpose and several such objects may be stacked into a compact stack for shipment and storing. Tubes having different diameters may be produced by means of objects of the same size.

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TUBE, IN PARTICULAR CORE TUBE FOR WINDING UP WEB SHAPED MATERIAL OR FOR STORING ARTICLES AND OBJECT TO BE USED FOR FORMING SUCH TUBE.

The present invention relates to a tube, in particular a core tube for winding up web shaped material or for storing articles, e.g. rolls of paper sheets.

From US,A, 2,328,335 a winding spool is known adapted for use in the manufacture, handling, and treatment of threadlike articles. The spool consists of a wave shaped sheet joined together along the edges extending parallel with the waves. These edges are joined in any convenient manner, e.g. by soldering, folding, or butt or lapped welding.

Moreover, from GB,A 1,303,063 a reel for filamentery material is known. The reel consists of a sheet corrugated in a specific way so as to produce a drum corrugated in the longitudinal direction and provided with end flanges. This reel is formed by connecting one side of a corrugation at each end of the sheet with each other.

Moreover, it is known to produce tubes, in particular for fulfilling the objects mentioned above, by winding up carton or paper upon a mandrel and to adhere the wound-up strips with each other for obtaining the tubes.

However, it is simultaneously a fact that within many branches of the industry tubes having several different diameters are to be used. For the manufacture of such tubes of carton or paper with different diameters, different winding mandrels are necessary and, moreover, the stock holding of such tubes in factories using many such tubes with different diameters causes serious difficulties because such tubes necessitate a considerable storing space and once manufactured their diameter cannot be changed. Furthermore, the manufacture of such tubes is connected with considerable costs.

It is the object of the present invention to provide a tube by means of which the drawbacks referred to above generally are avoided and this is according to the invention achieved by the tube consisting

of a piece of material bent to tubular shape, rows of hollow projections being provided in the piece of material, said rows extending transversely with respect to the longitudinal direction of the tube, the tops of said rows facing inwardly in the bent condition of the piece of material, the projections arranged along the edges of the piece of material extending in the longitudinal direction of the tube being adapted for mutual engagement, the projections arranged between the projections adapted for mutual engagement comprising abutment surfaces or edges facing each other for stiffening the shape of the tube. Hereby it is achieved that the tube may be manufactured from a planar piece of material which, when it is to be used, may be transformed into tubular shape in a simple way, viz. by bending in such a way that the projections face inwardly and by bringing the projections arranged along the edges of the piece of material extending in the longitudinal direction of the tube into engagement with each other. Moreover, one and the same piece of material may be transformed into tubes having different diameters, viz. corresponding to the width of the overlap used along said edges of the piece of material by the transformation into tubular shape. Furthermore, the pieces of material in question may be shipped and stored in the form of a stable, whereby considerable savings are achieved by shipping and storing. Furthermore, the pieces of material in question may be manufactured easily and cheaply, viz. by vacuum moulding of comparatively thin plastic foil material and the tube in question will have a considerable stability. Provided the mutually facing abutment surfaces or edges abut each other when the piece of material is transformed into tubular shape, a comparatively stiff tube will result because the parts of the piece of material facing outwardly will be subjected to tensions whereas the inwardly facing tops will be subjected to compressions in such a way that the tube at least along the greater part of the circumference in the reality will consist of a framework structure having generally circular cross-section shape, wherein the inwardly facing tops form the compression boom of the framework whereas the outwardly facing parts will form the tension boom of the frame structure. Even though the abutment surfaces in question do not abut when the piece of material has been converted to tubular shape, a well usable structure nevertheless will result because

deformation of the tube away from its circular form will produce the abutment in question, whereby the form will be stabilized. Moreover it will be understood that if the abutment surfaces press against each other, the stability will be very high. Due to the joining of the engagement projections variation of the wall thickness of the tube in the circumferential direction may occur seeing that the wall thickness may be greater at the position where the joint is positioned. However, this has proved to be of advantage, e.g. when the tube is used for winding up webs with adhered labels. In such a case a plurality of tubes may be arranged upon a winding up mandrel side by side and if such tubes are arranged with their thickened joints angularily offset with respect to each other, the webs being wound-up upon adjacent tubes will make a small movement perpendicular to their surfaces with respect to each other and such movement will contribute to counteract overlap between two adjacent webs along their edges during the winding up operation. Moreover, it is achieved that the tube may be formed, e.g. upon a winding up mandrel by wrapping the piece of material around the mandrel in such a way that it is not necessary to insert the tube upon the mandrel from one of its ends.

According to a preferred embodiment the tube according to the invention is characterized by the projections being arranged with the same mutual spacing in all the rows and by all the rows being arranged with the same mutual spacing; the projections being shaped generally as boxes, the bottoms of which constitute the tops of the projections and the walls of which diverge in direction away from the bottoms. In this case the stacked pieces of material will take up even less space because the projections in question may engage more or less into each other in such a way that the height of the stable is correspondingly reduced.

Moreover, under such circumstances the wall of the boxes may at the bottoms comprise recesses facing away from the bottoms and, furthermore, the bottoms of the boxes may have impressions for forming stiffening ribs. Hereby it is achieved that the pieces of material, when they are being stacked, are prevented from being pressed with their projections so far into each other that a locking

between the individual pieces of material occurs because the recesses will prevent the projections from being pushed so far into each other that the projections are mutually locked by wedge action and, furthermore, due to the impressions it is achieved that the capability of the compression boom referred to above to withstand the compression stresses prevailing therein is improved.

The present invention also relates to an object to be used for forming a tube, in particular a core tube for winding up web shaped material or for storing articles, e.g. paper sheet rolls. This object is according to the invention characterized by consisting of a piece of material in the form of a sheet of plastic, wherein rows of projections are provided by vacuum moulding, said rows extending transversely with respect to the longitudinal direction of the tube to be formed, said projections, along the two opposite edges of the piece of material extending in the longitudinal direction of the tube to be formed, being adapted so as to be brought into mutual engagement; the projections arranged between the engageable projections comprising mutually facing abutment surfaces or edges adapted for mutual abutment when the tube has been formed, for stiffening of the tube.

The projections dimensioned for mutual engagement may be of equal size in such a way that they may be coupled together simply by pressing the projections into each other and mutual locking by wedge action or the projections in question may be provided with snap locking means for mutual engagement.

A further possiblity consists in the outer dimensions of the projections to be inserted into other projections being a little greater, e.g. half the thickness of the material greater than the outer dimensions of the projection into which they are to be inserted.

According to a preferred embodiment for the article the snap locking means of each engagement projection may appropriately comprise a hollow boss having oppositely arranged under-cuts. Experiments have proven that by such an embodiment an excelent mutual locking between

the engagement projections is achieved even though they are of equal size and, moreover, the under-cuts have proven not to hamper the removal of the vacuum moulded objects from the moulds considerably.

According to the present invention the hollow boss may have the shape of a dome because it has been proven that such doomed shape adds to providing the under-cuts with a resiliency which makes the joining and the removal from the mould easier.

A further embodiment of the object according to the invention is characterized by channel-like projections being arranged between the stiffening projections provided with abutment surfaces or edges in each row. This has the result that the parts of the plastic material for forming the abutment surfaces or edges will be stretched to a smaller degree during the vacuum moulding than the case otherwise would be and, accordingly, an overdue weakening of the abutment surfaces or edges is avoided.

In the following the invention will be further explained with reference to the drawing, in which

fig. 1 shows a perspective picture of an embodiment of the tube according to the present invention,

fig. 2 shows, also in perspective, a part of a piece of material to be used by forming the tube shown in fig. 1,

fig. 3 shows a radial section through another embodiment of the tube,

fig. 4 shows a vertical section through a part of a piece of material for the tube in fig. 3,

fig. 5 shows a top view of a further embodiment of the piece of material according to the present invention,

fig. 6 shows, on an increased scale, a section through a part of a still further embodiment of the piece of material according to

the invention,

fig. 7 shows a section along section line VII-VII in fig. 6,

fig. 8 shows a top view of a projection of the piece of material shown in fig. 6,

fig. 9 shows a top view of a further embodiment of the piece of material for tubes,

fig. 10 shows in perspective a part of the piece of material in fig. 9 on an increased scale,

fig. 11 shows a side view of a part of the piece of material in fig. 10,

fig. 12,13, and 14 show sections along section lines XII-XII, XIII-XIII, and XIV-XIV, respectively, on fig. 11, and

fig. 15 shows an end view of a tube made from a part of a piece of material corresponding to the piece of material shown in fig. 9.

In the drawing 1 is a tube which, in particular, is intended to be used as a core tube by winding up web shaped material, e.g. webs of paper carrying removalbly adhered labels. The tube 1 is formed by bending a piece of material 2, of which a part is shown in fig. 2. The piece of material is provided with projections 3 arranged in rows extending perpendicular to each other seeing that the projections 3 form longitudinally extending rows 4 and transversely extending rows 5. The rows 4 are here termed longitudinally extending rows because they in the bent condition of the piece of material will extend in the longitudinal direction of the tube 1, whereas the rows 5 will extend transversely with respect to the tube. Accordingly the expressions "longitudinally extending" and "transversely" do not refer to the dimensions of the piece of material shown, seeing that the length thereof in the reality extends transversely with respect to the longitudinally extending

rows and its transverse dimension extends transversely with respect to the transverse rows.

The projections forming the longitudinally extending rows are arranged with equal mutual spacing in each of these rows and the projections forming the transverse rows are arranged with equal mutual spacing in these rows. According to the embodiment shown each projection 3 has a boxlike shape, seeing that each projection comprises a bottom 7 and four side walls 8,9,10,11. The side walls have a small divergence in direction away from the bottoms 7 and, accordingly, the projections form hollow boxes which expand a little in direction away from the bottoms as shown in fig. 2.

The tube 1 has been formed by bending a piece of material, of which a part is shown in fig. 2, into tubular shape with the tops of the projections, the bottoms 7 of the boxes, respectively, facing inwardly as it appears from fig. 1. In order to close the tubular shape one or a plurality of the longitudinally extending rows 4 at one end of the piece of material has been pressed into a corresponding number of longitudinally extending rows at the other end of the piece of material. According to the embodiment shown in figs. 1 and 2 the side walls of the boxes have slopes such that a wedge action for stabilizing the joint between the ends of the piece of material is achieved by pressing the boxes into each other. Accordingly, it will be understood that fig. 2 shows only a part of a piece of material which is necessary in order to form the tube 1 in fig. 1 because the latter comprises sixteen longitudinally extending rows of projections (of which some are formed due to the mutual joining of the end of the piece of material explained above), whereas the part of the piece of material shown in fig. 2 comprises only thirteen longitudinally extending rows of projections.

According to the embodiment shown in figs. 1 and 2 the distance between the longitudinally extending rows 4 at the bottoms 2 of the projections, combined with the slopes of the side walls and bridges connecting the individual rows are selected in such a way that mutually facing side walls of two adjacent transversely extending rows of projections, at least at the bottoms of the box shaped

projections, obtain abutment against each other along their edges 12,13 or surfaces adjacent thereto by the transformation into the tubular shape. Accordingly, the bottoms will form compression booms along the inner side of the tube, whereas the parts of the piece of material facing outwardly will form tension booms in the same way as in a framework girder. Accordingly, the tube achieves a compression prestressing inwardly and a tension prestressing outwardly in the circumferential direction, which gives the tube a high resistance against deformation away from the circular cylindrical shape shown. However, a direct abutment as explained above is not necessary because the tube even though will have a certain stability and by just a small deformation abutment will result in order to obtain the effect explained above. Moreover, due to the fact that the stresses in question may vary due to the resiliency of the plastic material, it will be understood that it is also possible to produce tubes with another diameter than the one shown in fig. 1 from the same piece of material, viz. by varying the width of the overlap between the end parts of the piece of material, the projections of which are pushed into each other in order to form the tube.

The piece of material shown in fig. 2 has been manufactured by vacuum moulding a sheet of plastic. Such vacuum moulding is made by positioning a sheet of plastic upon a mould having depressions corresponding to the outer shape of the box shaped projections 3 whereafter the heated sheet of plastic by suction through the mould is drawn down into the depressions of the mould whereby the side walls 8,9,10,11 of the individual projections are formed. Simultaneously between the depressions of the mould also narrow bridges will be formed which separate the hollow box shaped projections 3 along the openings thereof. Accordingly, it is the said bridges and the edges of the side walls of the projections adjacent thereto, which form the tension booms referred to above in the final structure.

Another embodiment of the tube according to the present invention and a part of a piece of material for forming this tube are shown in figs. 3 and 4. Also in fig. 4 only a part of the piece of material in question is shown. According to the embodiment shown in figs. 3

and 4 the piece of material comprises a plurality of longitudinally extending rows 15,16,17,18 of engagement projections along one of its edges and the dimensions of the engagement projections are reduced (shown exaggerated in the drawing for the sake of clarity) with respect to the other projections of the piece of material. In fig. 3 it is illustrated how the greater engagement projections at the opposite end of the piece of material has been inserted into the corresponding rows of comparatively small engagement projections 15,16,17,18. In spite of the reduced size of the projections of the rows 15,16,17,18 they, however, are arranged with the same pitch both longitudinally and transversely as the comparatively great projections in order to make the engagement as shown in fig. 3 functioning. Thereby a very firm joint is achieved.

It will be immediately understood that the diameter of the tube shown in fig. 3 according to the embodiment according to figs. 3 and 4 may vary depending upon whether one, two, three, or four of the rows of small projections 15,16,17,18 are used for joining by overlap.

According to the embodiment of a piece of material as shown in fig. 5 another solution has been selected as regards the joining of the ends of the piece of material in order to obtain the tubular shape because the outer longitudinally extending rows of engagement projections at each end of the piece of material shown are shaped in a specific way. As seen from the upper left corner of the piece of material in fig. 5 an engagement projection 18 having comparatively small dimensions is arranged. Below this projection 18 and in the same longitudinally extending row an engagement projection 19 having comparatively large dimensions is arranged and below the latter an engagement projection corresponding to the engagement projection 18 is arranged and further below again an engagement projection corresponding to the engagement projection 19 is arranged. In the next row of engagement projections as seen from the left-hand side in fig. 5 the situation is the opposite because this row at the top starts with a comparatively large engagement projection 19 whereafter a smaller engagement projection follows corresponding to the engagement projections 18 and then again an engagement

projection follows corresponding to the engagement projections 19 and the lowermost engagement projection corresponds to the engagement projections 18.

At the opposite end of the piece of material in question the conditions are the opposite because the topmost engagement projection shown to the right is comparatively large and, accordingly, corresponds to the engagement projections 19 whereafter a comparatively small engagement projection 18 follows and then again a large engagement projection 19 followed by a small engagement projection 18 and as regards the penultimate row to the right the conditions are the opposite.

Accordingly, it will be understood that when a piece of material as shown in fig. 5 is transformed into tubular shape, "large" engagement projections 19 will be pressed into "small" engagement projections 18 and make a "bite connection" for forming a strong joint extending in the axial direction of the tube no matter whether one end overlaps the other or vice versa. Simultaneously "small" engagement projections will be introduced into "large" engagement projections and, accordingly, will not contribute to the locking effect.

In fig. 6 a vertical section through a part of a piece of material according to a further embodiment is shown. The section is positioned so that two longitudinal rows as defined above are seen in cross-section. According to this embodiment it will be seen that the bottoms 7 of the projections are not planar, but have an angular or edged concave shape whereas the lower edges of the opposite side walls 9,11, cf. fig. 2, have a corresponding convex shape. Accordingly, the bridges connecting the mouths of the downwardly open box shaped projections will have a corresponding downwardly convex shape. This shaping has been selected because a tube bent from a piece of material as shown in fig. 6 thereby will achieve a more smoothly curved external circumference, viz. corresponding to the convex shape of the boxes shown below in fig. 6. Thereby the sharp edged shape, which otherwise could result in connection with comparatively small tubes having comparatively large box shaped

projections, is avoided. Moreover, the interior shape of the tube will also be more smoothly curved whereby the positioning, e.g. upon a mandrel of a machine for winding up or winding off web shaped material will be easier.

According to the embodiment shown in fig. 6 a generally rectangular depression 20 is provided, each comprising a bottom 21 and side walls 22 diverging upwardly from the bottom. Such depressions serve to strengthen the inwardly facing parts of the projections in such a way that they will be better suited for taking up the compression stresses to which they may be subjected when the piece of material is transformed into tubular shape.

In connection with the embodiment according to fig. 6 it should be noticed that the width of the bridge 24 connecting two adjacent longitudinal rows of projections has a width of approximately 2 mm and that the side walls starting therefrom of the projections have a divergence such that a distance of approximately 3 mm results between the bottoms 7. The result is that when a piece of material as shown in fig. 6 is rolled into tubular shape, a "break angle" of approximately 36° is formed between two longitudinal rows of projections at abutment of their tops and if projections are used having a length (in the transverse direction of the tube) of 16.2 mm and a height of approximately 5.5 mm, tubes may be made with eight, nine, or ten longitudinal rows of projections and having an inner diameter of 40, 45, or 50 mm, respectively by means of a piece of material comprising eleven longitudinal rows of projections.

Moreover, from fig. 6 it appears how engagement projections may be shaped in order to achieve a snap locking action by pushing locking projections into each other because at the top to the left in fig. 6 a bulge 26 on one of the side walls of the engagement projection shown there is shown adjacent the bottom 7. A corrosponding inward depression 27 corresponds to the bulge 26 and, accordingly, it will be understood that if such engagement projection is pushed into another corresponding engagement projection, the bulge and the depression will engage for keeping the engagement projections together. According to this embodiment the projections to be

inserted into other projections need not have dimensions which produce stresses in the embracing projections. Moreover, at the top to the right in fig. 6 it has been shown that the projections adjacent their bottoms may have recesses 30 facing away from the bottoms, and which, when such pieces of material are arranged one upon another, prevents a too deep engagement because the bottoms of a lower piece of material will abut the recesses in question.

Moreover, one of two opposite side walls may be provided with a depression 31 as shown at the center of fig. 6 for accommodating a corresponding projection 32 on the adjacent abutment surface in such a way that a mutual displacement of the two abutment surfaces with respect to each other is prevented. Simultaneously such engagement will stabilize the tube in question as regards the torsion stiffness. Such increased torsion stiffness may also be obtained if one of the sides is provided with two or more projections and the opposite side is provided with corresponding projections arranged opposite the interspaces between the first mentioned projections because such projections, when they engage, will prevent displacement of two adjacent projections.

By experiments forming the basis of the present invention it has been proven that good results are achieved by producing the pieces of material from plastic foil sheets having a thickness of approximately 0.2-0.3 mm. Such material will also allow the moulded sheet to be removed from the mould in spite of the small under-cuts necessary for forming the snap locking means 26,27, the engagement means 31,32, and the recesses 30. Moreover, it should be mentioned that the pieces of material in question may be cut from great sheets shaped as explained and according to the diameter and length of the tubes requested because it will be understood that the length of the tubes may be far longer than shown in the drawing. Such cutting may be made easier by providing the sheet with weakening lines or interrupted weakening lines between the rows of projections extending transversely with respect to the tubes to be made.

According to the piece of material shown in fig. 9 the engagement projections 40 are shaped in a specific way because each engagement

projection is shaped as a box 41 provided with snap locking means 42. As it appears from fig. 14, the snap locking means 42 are shaped as a hollow boss 43 the opposite side walls 44,45 which are undercut, i.e. they converge in direction away from the bottoms 46 of the bosses. The side walls 44,45 are domed in such a way that they undergo an outward flexion when two engagement projections are pushed into each other and simultaneously and excelent snap locking action is achieved. The hollow bosses referred to merge smoothly into the sides 48 and tops 49 of the box shaped projections in question in order to avoid too sharp bents. The end walls 50,51 of the engagement projections are inclined a little more than the walls of the other projections 53. The latter are in each transverse row (i.e. transverse with respect to the longitudinal direction of the tube formed) mutually connected by means of channel-like projections 54. The result is that the end wall portions or edges 56,56 intended to serve as abutment surfaces or edges in the tube when shaped, cf. fig. 15, during the vacuum moulding, will not be stretched to the same degree as the case otherwise would be and, accordingly, it is achieved that the abutment surfaces or edges referred to generally maintain the same thickness as the original plastic sheet whereby their stiffening action explained above will be excelent.

According to the embodiment last explained two rows of engagement projections are provided in such a way that tubes may be made having two different diameters, but it will be understood that also more such rows may be provided.

As it appears from fig. 15, only the stiffening projections 53,53 have mutual abutment according to the embodiment shown for stabilizing the circular cylindrical shape of the tube, but nevertheless a stable shape is achieved.

Also according to the embodiment according to fig. 9 weakening lines 58 are provided in the piece of material along which the piece of material may be divided according to the requested length of the tubes in question.

Claims.

1. Tube, in particular a core tube for winding up web shaped material or for storing articles, e.g. rolls of paper sheets, c h a r a c t e r i z e d by the tube (1) consisting of a piece (2) of material bent to tubular shape, rows of hollow projections (3) being provided in the piece of material, said rows extending transversely with respect to the longitudinal direction of the tube, the tops (7) of said rows facing inwardly in the bent condition of the piece of material, the projections (3) arranged along the edges of the piece of material (2) extending in the longitudinal direction of the tube being adapted for mutual engagement, the projections arranged between the projections adapted for mutual engagement comprising abutment surfaces or edges (12,13) facing each other for stiffening the shape of the tube.

2. Tube according to claim 1, c h a r a c t e r i z e d by the projections (3) being arranged with the same mutual spacing in all the rows and all the rows being arranged with the same mutual spacing; the projections (3) being shaped generally as boxes, the bottoms of which constitute the tops of the projections and the walls (8,9,10,11) of which diverge in direction away from the bottoms (7).

3. Tube according to claim 2, c h a r a c t e r i z e d by the walls (8,9,10,11) of the boxes at the bottoms comprise recesses (30) facing away from the bottoms and by the bottoms of the boxes (7) having impressions (20) for forming stiffening ribs.

4. Object to be used for shaping a tube, in particular a core tube for winding up web shaped material or for storing articles, e.g. paper sheet rolls, c h a r a c t e r i z e d by the object consisting of a piece of material (2) in the form of a sheet of plastic, wherein rows of projections are provided by vacuum moulding, said rows extending transversely with respect to the longitudinal direction of the tube to be formed, said projections, along the two opposite edges of the piece of material extending in

the longitudinal direction of the tube to be formed, being adapted so as to be brought into mutual engagement; the projections arranged between the engageable projections comprising mutually facing abutment surfaces or edges (12,13) adapted for mutual abutment when the tube has been formed, for stiffening of the tube.

5. Object according to claim 4, characterized by the projections adapted for mutual engagement being of equal size in such a way that they may be coupled together simply by pressing the projections into each other and mutual locking by wedge action.

6. Object according to claim 4, characterized by the outer dimensions of the projections to be inserted into other projections are a little greater, e.g. half the thickness of the material greater than the outer dimensions of the projections into which they are to be inserted.

7. Object according to claim 4, characterized by the projections being provided with snap locking means (26,27) for mutual engagement.

8. Object according to claim 4, characterized by the snap locking means of each engagement projection comprise a hollow boss (43) having oppositely arranged under-cuts (44,45).

9. Object according to claim 8, characterized by the hollow boss having a domed shape.

10. Object according to claim 4, characterized by channel-like projections (54) being arranged between the stiffening projections (53) provided with abutment surfaces or edges in each row.

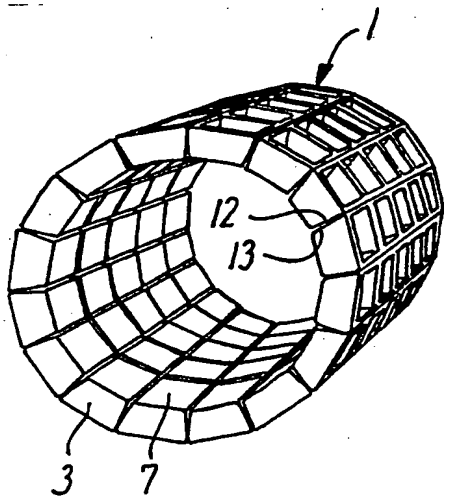

FIG. 1

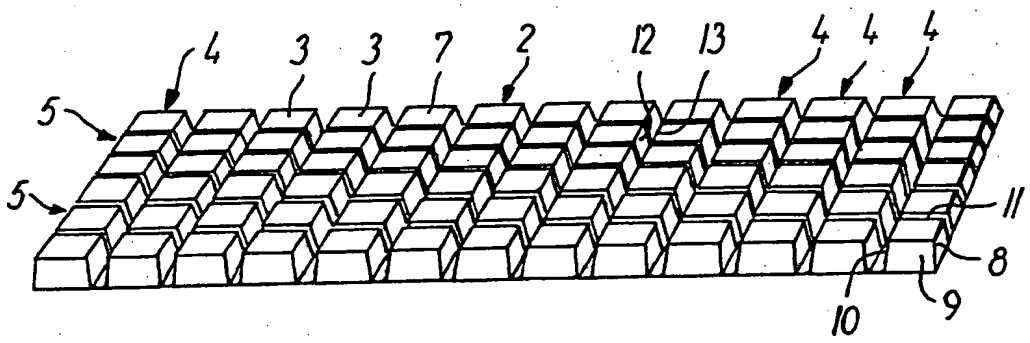

FIG. 2

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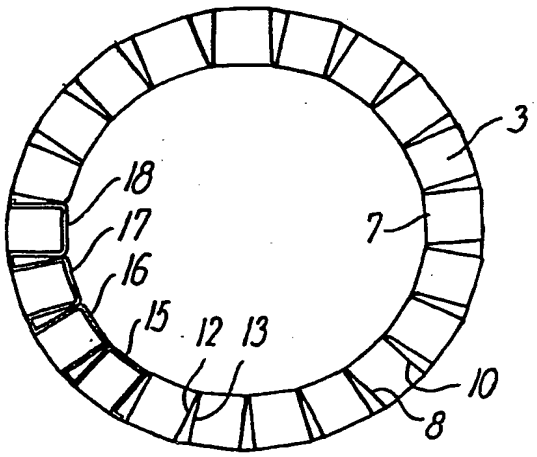

FIG. 3

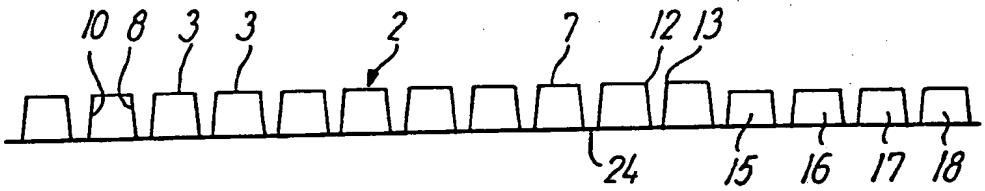

FIG. 4

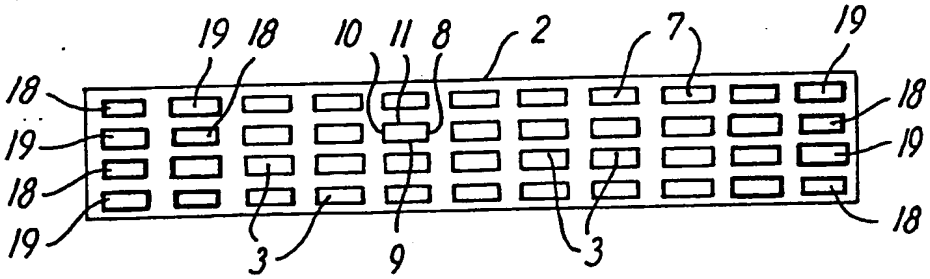

FIG. 5

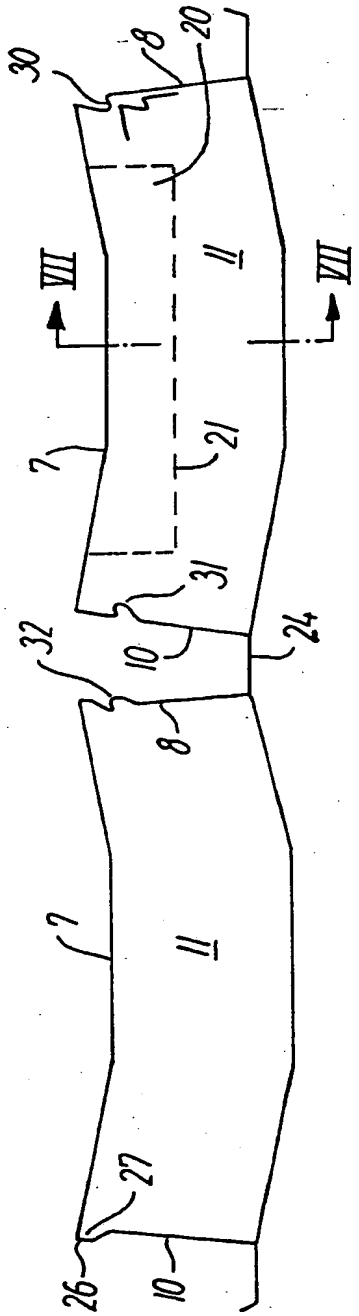

FIG.6

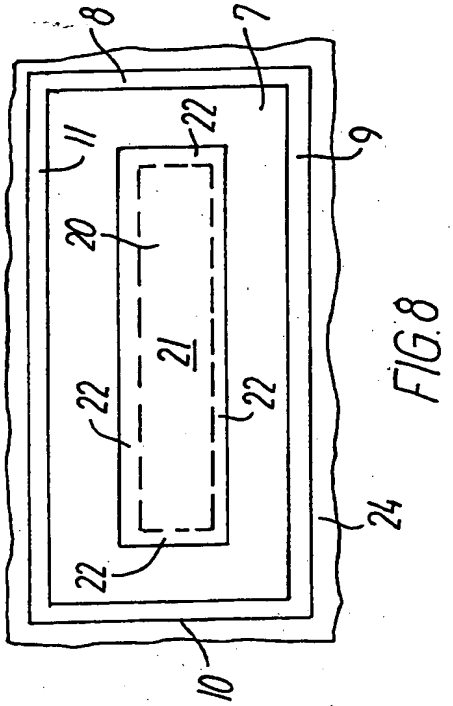

FIG.8

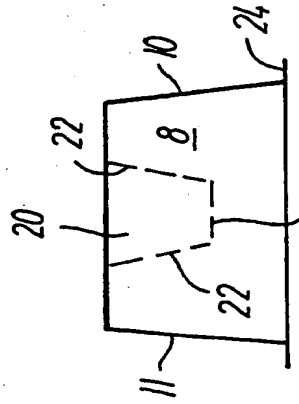

FIG.7

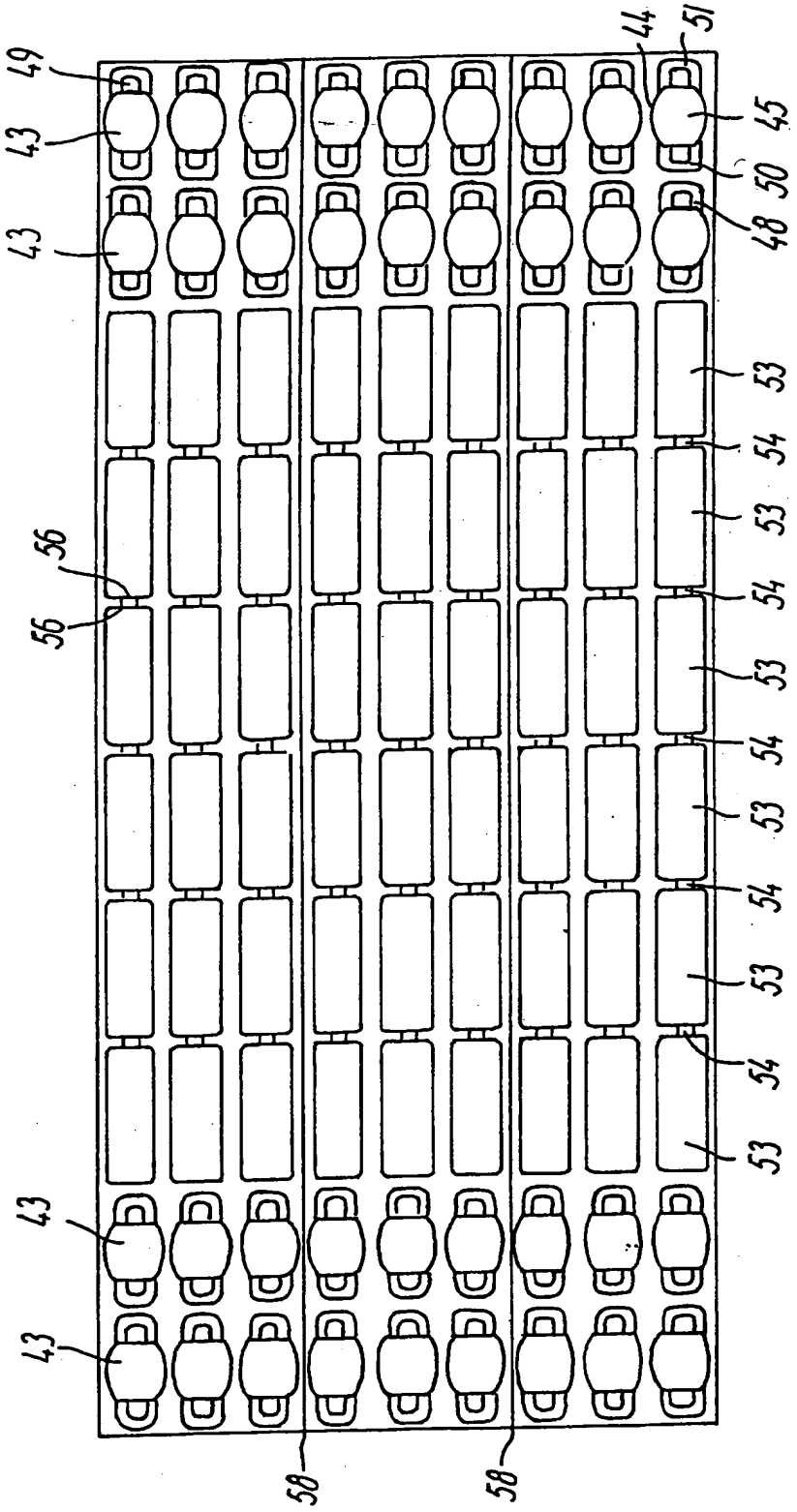

FIG. 9

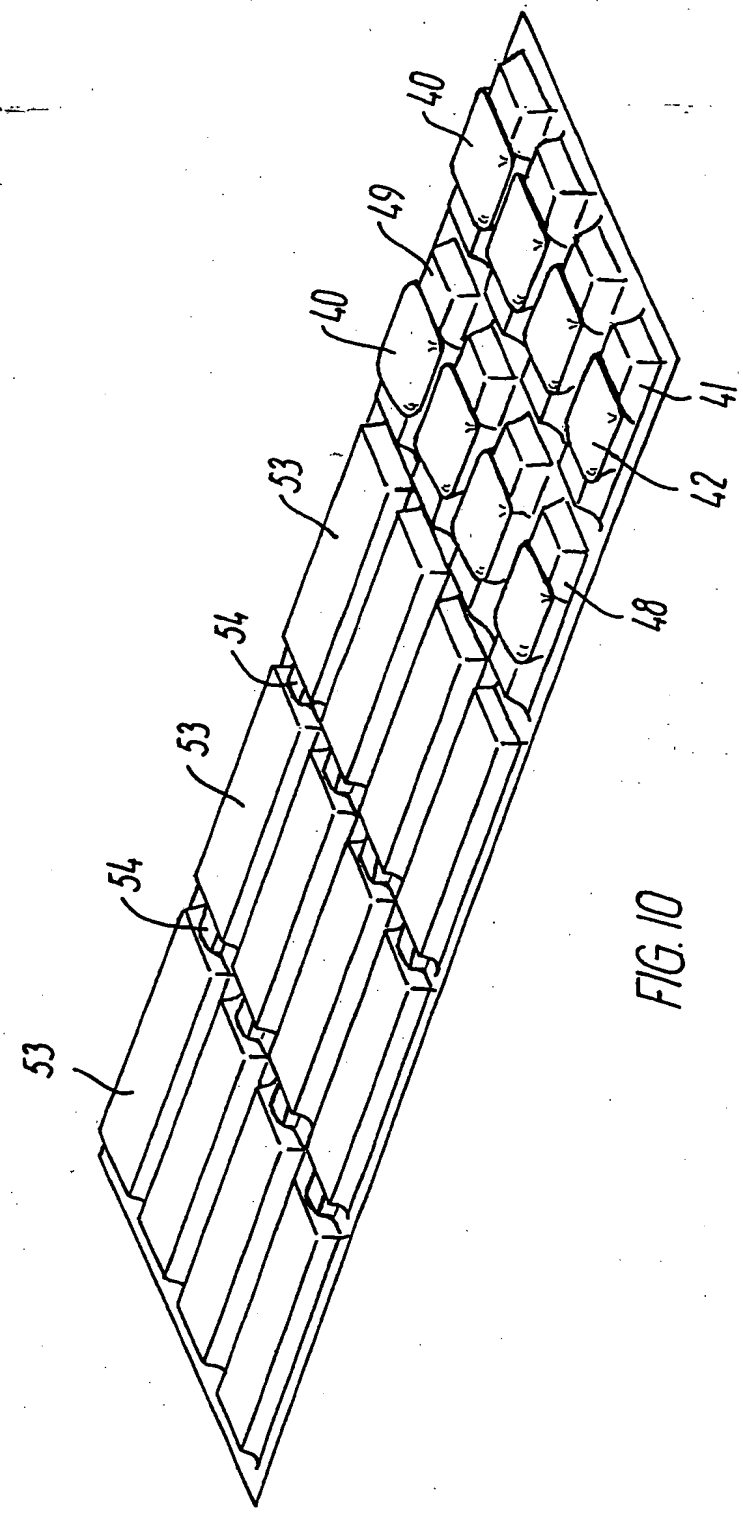

FIG. 10

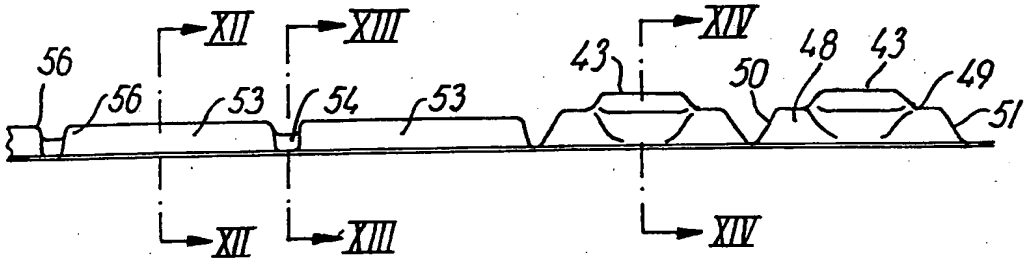

FIG. 11

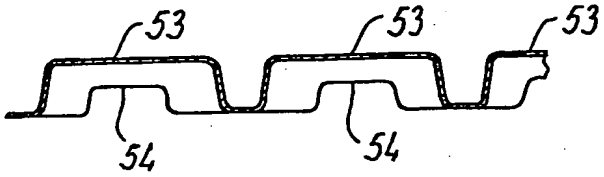

FIG. 12

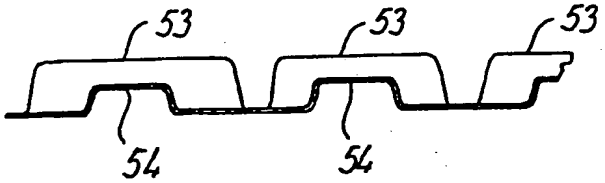

FIG. 13

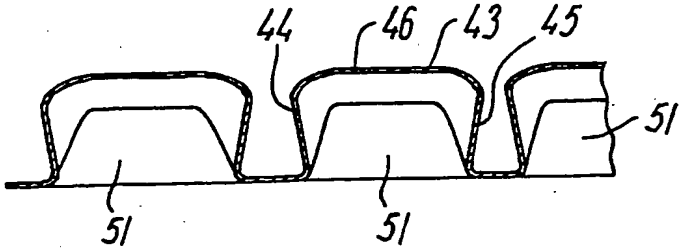

FIG. 14

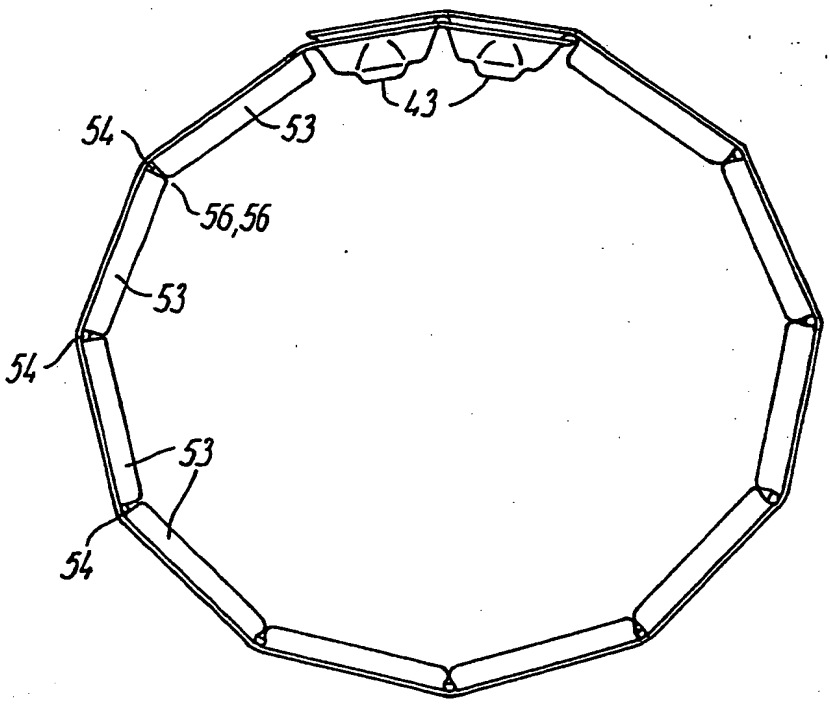

FIG. 15

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 90/00233

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 65 H 75/22, /50

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 65 H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	GB, A, 1249886 (SIEMENS AKTIENGESELLSCHAFT) 13 October 1971, see page 2; figures 7-10,15-23, --	1-10
A	GB, A, 1296983 (BP CHEMICALS LIMITED ET AL) 22 November 1972, see page 2, line 21 - line 26; figure 2 --	1-10
A	GB, A, 1303063 (BP CHEMICALS LIMITED ET AL) 17 January 1973, see page 1 - page 2; figure 1 --	1-10
A	GB, A, 2165214 (SMITHS INDUSTRIES PUBLIC LIMITED COMPANY) 9 April 1986, see abstract; figures 1,5 --	1-10

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
29th November 1990	1990 -12- 11
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Kjell Lundahl

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 2328335 (L.S. FRYER ET AL) 31 August 1943, see page 1, line 50 - line 55; figures 1-3 --	1-10
A	US, A, 2339245 (A.H.BATES) 18 January 1944, see figures 4-9 --	1-10

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/DK 90/00233

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 90-11-01
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 1249886	71-10-13	NONE	
GB-A- 1296983	72-11-22	NONE	
GB-A- 1303063	73-01-17	NONE	
GB-A- 2165214	86-04-09	NONE	
US-A- 2328335	43-08-31	NONE	
US-A- 2339245	44-01-18	NONE	